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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/772,893	02/04/2004	Pravin K. Narwankar	008209	5371

7590 06/17/2008  
APPLIED MATERIALS, INC.  
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EXAMINER
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STOUFFER, KELLY M

ART UNIT	PAPER NUMBER
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1792

MAIL DATE	DELIVERY MODE
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06/17/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/772,893	<b>Applicant(s)</b> NARWANKAR ET AL.	
	<b>Examiner</b> KELLY STOUFFER	<b>Art Unit</b> 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 16 May 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,3,4,6-12,15,17-22,24 and 26-42 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3,4,6-12,15,17-22,24 and 26-42 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                       | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>5/16/08</u> .   | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 16 May 2008 has been entered.

### ***Response to Arguments***

Due to amendments, the 25 USC 112 1<sup>st</sup> paragraph rejections are withdrawn. Applicant's arguments filed 15 May 2008 have been fully considered but they are not persuasive. The applicant argues that Bernashel does not teach incorporating nitrogen into a dielectric film using ammonia gas in a rapid thermal annealing process and Bernashel teaches away from using the claimed temperature ranges. The applicants are correct in stating that using ammonia is undesirable in the process of Bernashel because it leads to incorporation of hydrogen atoms that give fixed charges and increase the trapping of electrons in the film (column 1 lines 24-30). But because this is undesirable in the applications of Bernashel does not negate that it is disclosed to be a well-known nitriding gas in the prior art as stated by Bernashel.

Using ammonia instead of NO in Bernashel would have been obvious because the substitution of one known element for another would have yielded predictable results to one of ordinary skill in the art at the time of the invention. And further, using ammonia instead of NO in Bernashel would have been obvious because “a person of ordinary skill has good reason to pursue the known options with his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense.” In this case, Bernashel gives a finite number of options for nitriding gases in column 1 et seq.: ammonia, NO and N<sub>2</sub>O. See *KSR International Co. V. Teleflex Inc.* 550 U.S.--, 82 USPQ2d 1385 (2007).

As to the temperature limitations, Bernashel teaches the claimed temperatures in a RTP process involving NO but does not find the claimed temperature range desirable because it does not localize enough nitrogen at the interface between the substrate and the gate oxide layer (column 1 lines 47-55). However, one of ordinary skill in the art would recognize that Bernashel can be modified to this temperature depending on the amount of nitrogen desired at the interface between the substrate and the gate oxide layer. It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the temperatures of Bernashel within the claimed ranges, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 105 USPQ 223 (CCPA 1955).

Therefore, the rejections of the previous office action are maintained and repeated here.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 3-4, 6-9, 12, 14-15, 17, 24, 26-28, 31, 33-35 and 37-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bensahel et al. (WO99/043023 -- US Patent 6372581 to Benashel et al. is used as a translation of WO99/043023 for the purposes of this rejection as it is a 35 USC 371 application of WO99/043023)

As to claim 1, Bensahel et al. discloses a method of forming nitrogen-containing dielectric film comprising incorporating nitrogen into a dielectric film using  $\text{NH}_3$  (column 1 lines 23-25 – though it is not preferred its utility as a nitriding gas is disclosed and may be interchanged with NO used in Bensahel) and a RTP anneal wherein the nitrogen forms on peak on the surface of the dielectric film (Figures 2 and 3, also examples). Using ammonia instead of NO in Bernashel would have been obvious because the substitution of one known element for another would have yielded predictable results to one of ordinary skill in the art at the time of the invention. And further, using ammonia instead of NO in Bernashel would have been obvious because “a person of ordinary skill has good reason to pursue the known options with his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense.” In this case, Bernashel gives a finite number of options for nitriding gases in column 1 et seq.: ammonia, NO and  $\text{N}_2\text{O}$ . See *KSR International Co. V. Teleflex Inc.* 550 U.S.--, 82 USPQ2d 1385 (2007).

As to claim 3, Bensahel et al. desires localization of the nitrogen to the interface of the nitrided film. Though the percentage of nitrogen present is not explicitly stated by Benashel, one of ordinary skill in the art would recognize that the amount of nitrogen present in the film will be minimized until this is achieved, absent evidence showing

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criticality for the percentage of nitrogen claimed. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 105 USPQ 223 (CCPA 1955).

As to claim 4, the film is less than or equal to 12 angstroms (column 3 et seq.).

As to claim 6, the dielectric is silicon dioxide (column 2 lines 60-67).

As to claim 7, silicon oxynitride is formed (column 2 lines 60-67).

As to claim 8, the limitations are taught as discussed above, and Benashel et al. additionally discloses an oxide capping layer in the Examples.

As to claim 9, the RTP process described in Bensahel et al. uses the claimed temperatures (column 1 lines 35-55). , Bernashel teaches the claimed temperatures in a RTP process involving NO but does not find the claimed temperature range desirable because it does not localize enough nitrogen at the interface between the substrate and the gate oxide layer (column 1 lines 47-55). However, one of ordinary skill in the art would recognize that Bernashel can be modified to this temperature depending on the amount of nitrogen desired at the interface between the substrate and the gate oxide layer. It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the temperatures of Bernashel within the claimed ranges, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 105 USPQ 223 (CCPA 1955).

As to claim 12, Bensahel et al. includes the provisions of the process as discussed in claim 1 and a post annealing process (column 3 lines 1-5).

As to claim 14, Bensahel et al. desires localization of the nitrogen to the interface of the nitrided film. Though the percentage of nitrogen present is not explicitly stated by Benashel, one of ordinary skill in the art would recognize that the amount of nitrogen present in the film will be minimized until this is achieved, absent evidence showing criticality for the percentage of nitrogen claimed. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 105 USPQ 223 (CCPA 1955).

As to claim 15, the film is less than or equal to 12 angstroms (column 3).

As to claim 17, the dielectric is silicon dioxide (column 2 lines 60-67).

As to claims 24, 26-28, 31, and 38-42 the limitations are disclosed as discussed above.

As to claims 33-35 and 37, the ultra-low pressure is taught in the abstract of Bensahel et al.

Claims 10, 11, 29, 30 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bensahel et al. in view of Niimi et al. (US Patent Publication 2002/0197884 A1)

Bensahel et al. includes the limitations of claims 10, 11, 29, 30 and 32 as discussed above except for using annealing in a non-nitridation atmosphere as the post



anneal process. Niimi et al. teaches a post anneal annealing process under re-oxidizing conditions to reduce defect density of the layer and improve channel carrier mobility (also see process parameters as discussed above for this process in Niimi et al.).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Bensahel et al. to include a post anneal annealing process under re-oxidizing conditions as taught by Niimi et al. in order to reduce defect density of the layer and improve channel carrier mobility.

Claims 18-22 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bensahel et al. in view of US Patent Publication 2002/0119674 A1 to Thakur.

Bensahel et al. discloses the limitations of claims 18-23 and 36 as discussed above except for using a cluster tool in the manner claimed. Thakur teaches clustering various steps in a similar process in the manner claimed in order to reduce contamination in the oxide and other layers (paragraphs 0008 and 0034).

It would have been obvious to modify Bensahel et al. to include using a cluster tool in the manner claimed as taught by Thakur in order to reduce contamination in the oxide and other layers.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KELLY STOUFFER whose telephone number is

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(571)272-2668. The examiner can normally be reached on Monday - Thursday 7:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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